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The Analysis of Learning Outcomes through Problem-Based Learning Model Approach On Circle Materials

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Abstract
Students still consider mathematics learning in school difficult. One of the factors causing this difficulty is because mathematics material is dominated by abstract material. The purpose of this research is: to determine the learning outcomes of student learning outcomes through the application of the Problem Based Instruction Model. The selection of a learning model plays a large enough role to achieve educational goals. For that, we need a learning model that is able to increase student interest, motivation and learning outcomes. One learning model that can be used is Problem Based Instruction which emphasizes student activity. Problems in the learning process are directed to those related to everyday life so that students can immediately understand them. The population in this study were all students of 8th grade totaling 50 students.The sample in this study were students of 8th grade State Junior High School 14 Banda Aceh, as many as 25 students. This study used a Quasi-experimental approach with a one-shot case study design with quantitative research. Data collection was carried out using test instruments. The data processing technique is to use the t-test. The results showed that student learning outcomes in the material tangent to the inner and outer partnership of two circles of 8th grade State Junior High School 14 Banda Aceh achieved student learning learning outcomes according to the Minimum Completeness Criteria (KKM) set by State Junior High School 14 Banda Aceh.

Keywords: learning outcomes , problem based instruction, circle

INTRODUCTION

Mathematics is a subject that is taught at every level of education in Indonesia from Elementary School (SD) to Senior High School (SMA). According to Kline (Suwangsih & Tiurlina, 2010), mathematics is not isolated knowledge that can be perfect because of itself, but the existence of mathematics is primarily to help humans understand and master social, economic and natural problems. This opinion means that mathematics is closely related to everyday life (contextual).

With mathematics, humans undergo activities and are able to logically solve problems faced in everyday life (Saleh, M., Ernisa., Aklimawati., & Mahmuzah, R., 2019). According to the Ministry of Education and Culture 2013 mathematics learning has several objectives, namely: increasing intellectual abilities, especially high-level abilities of students, forming students' ability to solve problems systematically, obtaining high learning outcomes, training students in communicating other people's ideas, especially in writing scientific papers , and develop student character. It can be concluded that mathematics is a science that is obtained from the thought process and is based on logic to solve problems in everyday life (Irma Aryani dan Maulida, 2019). As a basic science, mathematics should be a subject that students are interested in and enjoyed. But in reality, the results achieved by students in participating in teaching and learning activities are still very low (Imadiah, 2019). It is not realized by many students and also by the public that mathematics has tremendous benefits in everyday life, makes us more patient, and helps us to become more conscientious, careful and less careless individuals. Therefore, it can be said that everyone needs mathematical knowledge in various forms according to their needs.

With many people who consider mathematics to be a difficult and unpleasant subject, the student learning outcomes in mathematics tend to be low. Likewise with the mathematics learning outcomes of State Junior High School 14 Banda Aceh, from the results of observations at State Junior High School 14 Banda Aceh in January 2020, there are several things that can cause low student learning outcomes, among others: when the teacher explains the material only some students pay attention, teachers tend to provide more information in explaining material, teacher teaching methods that are not attractive to students and lack of understanding of mathematical concepts, most student activities are only listening and taking notes.

Abdurrahman (2012) states that the factors that cause students' low or lack of understanding of mathematical concepts, including the learning methods used by teachers, for example in learning oriented towards traditional approaches that place students in the teaching and learning process as listeners. Meanwhile, according to Slameto (2013), learning outcomes are influenced by 3 factors, namely internal factors (derived from within each individual such as health, attitudes, talents, interests, motivation and concentration), external factors consisting of family factors, school factors. (teaching and learning methods) and community factors. This is due to the assumption that mathematics is one of the most difficult and frightening subjects compared to other subjects.

One learning model that is thought to improve learning outcomes in the cognitive aspects, student interest and response in solving daily life problems is the Problem Based Instruction (PBI) learning model. The Problem-Based Learning model emphasizes student activity for learning and problems in the material are more directed at everyday life so that it can be directly understood by students. The knowledge that

students receive passively makes mathematics ineffective for students (Suci Mahya Sari, 2020).

The Problem Based Instruction (PBI) model was developed to help students develop thinking skills, problem solvers, intellectual skills, learn various adult roles through their involvement in real experiences or simulations, and become autonomous and independent learning Aryanti Nurhidayati, Rima Sri Agustin, Taufiq Lilo Adi S., Roemintoyo & Eko Supri Murtiono (2013).

According to Farina Amalia, Saukani & Salminawati (2018) teaching the problem based instruction model is a learning approach where students work on authentic problems with the intention of compiling their own knowledge, developing inquiry and higher-level thinking skills, developing independence and self-confidence.

Purwaningsih (2013) Problem Based Instructions were developed to help students develop thinking skills, problem solving and intellectual skills, learning as a role, through learning experiences in real life, the interaction between stimulation and response, which is the relationship between the two directions of learning and the environment. Furthermore (Saleh, M., Prahmana, R, C, I., Isa M., 2018) said "The learning model emphasizes algorithms, without giving enough time and chance to find the knowledge, it will be meaningless for students".

The environment provides input to students in the form of assistance and problems, while the nervous system of the brain functions to interpret the aid effectively so that what is faced can be investigated, assessed, and analyzed as well as sought solutions. Students' experiences obtained from the environment and make materials and materials in order to obtain an understanding that can be used as guidelines and learning objectives. The learning process that involves many of the students' senses results in a high quality of learning, both in terms of memory endurance against objects seen and held as well as understanding the concept of the idea being studied becomes more firmly controlled by students. However, learned Saleh, M (2013).

This learning model rests on developing thinking skills among students through problem solving exercises, therefore students are involved in the process and the acquisition of the solution product. Saleh et al (2019) said: It is hard to imagine how a learning process runs and what theresult is for people who do not possess the vision ability whilethey want to see color, or, for people who have the visionability but they never see how the color looks.

Thus this model will also develop thinking skills through empirical facts and the ability to think rationally, so that repeated practice can build intellectual skills and at the same time mature students. Students act as self-regulated learners, meaning that through this learning model students must be involved in real experiences or simulations so that they can act as scientists or adults. This model is certainly not designed so that the teacher provides as much information as possible to students, but the teacher acts as a learning facilitator by encouraging students to be willing to do something and express it verbally. Due to all the characteristics of the Problem Based Instructions, it can be

predicted that student learning outcomes will increase with the application of Problem Based Instructions learning.

One of the subjects of mathematics taught in 8th grade SMP is a tangent to the inner and outer communion of two circles. The application of the tangent to the inner and outer union of the two circles is also used in everyday life, for example in the wheel drive wheel (pulley) with the drive rope, sewing machines, and motorcycle chains. Based on the researcher interview with the mathematics subject teacher at SMPN 14 Banda Aceh, it was found that students had difficulty calculating the length of the tangent line inside or outside the circle.

The problems of 8th grade students at State Junior High School 14 Banda Aceh are caused by the learning process in the classroom which is applied which is still centered on the teacher so that students do not have the opportunity to construct their own knowledge. During the learning process in class, students rarely ask questions or answer questions from the teacher. In general, students are less active in participating in lessons, where class activity is still dominated by clever students. Most students can only do the same problems with the example given by the teacher. In fact, some students consider the material tangent to the inner and outer communion of the two circles less interesting because it has no relevance to real life.

Based on these problems, a learning alternative is needed that can involve students actively collaborating, discussing and arguing with classmates in order to find mathematical concepts by themselves through presenting problems that are close to the real life of students. The presentation of these problems aims to make students closer to mathematics and students can understand the benefits of mathematics in everyday life and provide meaningful experiences in learning which in turn can increase student learning outcomes. One of the learning alternatives that can be used is the Problem Based Instruction (PBI) model.

The PBI model is a learning model that focuses on organized learning experiences including investigation and problem solving, especially problems related to everyday life (Fitria et al, 2013). This PBI model causes motivation and curiosity to increase and also makes changes in learning, especially in terms of the role of the teacher. The teacher does not only stand in front of the class and acts as a student guide in completing what has been finished, but the teacher goes around the class facilitating discussions, asking questions, and helping students become more aware of the importance of learning (Pratiwi et al, 2013).

Learning Outcomes

Learning for some people is defined as an action or change to collect or memorize facts that occur in the form of information or learning material. However, real learning is not only limited to the above understanding. According to Dimyati and Mudjiono (2013) “learning is a complex action and behavior. As an action, learning is only experienced by students themselves. Students are the determinants of the learning process or not. Meanwhile, Djamarah (2011) "learning is a series of mental and physical activities to obtain a change in behavior as a result of individual experiences in interaction with their environment concerning cognitive, affective, and psychomotor."

A person is said to have learned something when a certain change occurs in him. According to psychological knowledge, learning is a process of change, namely changes in behavior as a result of interaction with the environment in fulfilling their daily needs.

A process of changing activities, reactions to the environment, these changes cannot be called learning if they are caused by a temporary condition such as fatigue or caused by drugs such as drunkenness.

Slameto (2010) the definition of learning is "a business process carried out by a person to obtain a whole new change in behavior, as a result of his own experience in interaction with his environment". Learning occurs when the situation of the stimulus together with the contents of the memory affects the student in such a way that the change from time to time after he experiences continuous learning, is not only due to the growth process. Behavioral changes as a result of the learning process (learning outcomes) are relatively sedentary in one's behavior as a result of training or experience.

According to the theory of Robert Gagne (Slameto, 2010), the learning problem provides two definitions, namely

a. Learning is a process of gaining motivation in knowledge, skills, habits and behavior.
b. Learning is the mastery of knowledge and skills obtained from instructions

Based on some of the definitions about learning above, it is concluded that learning is a process of activities carried out by a person to get a change in himself for the better, both in behavior (behavior) or to gain broader knowledge through training or experience. .

In carrying out teaching and learning education, it can be seen that the expected changes occur in accordance with predetermined goals, the intended objectives are in the form of student learning outcomes. Learning can be defined as a process that is carried out by a person consciously to get a change in behavior or to gain broader knowledge through training or experience of the individual himself in interaction with his environment.

Learning and teaching are inseparable concepts. Learning refers to what a person has to do as a subject in learning. Meanwhile, teaching refers to what a teacher should do as a teacher. Two teaching and learning concepts carried out by students and teachers are integrated in one activity. Between the two there is an interaction with the teacher.

The teaching and learning process in the classroom has a transactional purpose, meaning that it is known clearly and operationally by teachers and students. The goal is achieved if students obtain learning outcomes as expected in the teaching and learning process. Therefore, learning outcomes must be formulated and assessed. So learning outcomes are the level of mastery achieved by students in participating in teaching and learning programs in accordance with established educational goals which include cognitive, affective, and psychomotor aspects.

Thus, the knowledge above can be concluded that a process will cause changes to occur in a person. Therefore, to find out the extent of changes experienced by students, an assessment activity is carried out, which is an action or activity to see the extent to which the learning objectives can be achieved by students in the form of learning outcomes obtained after they take the learning process. So learning outcomes are essentially abilities obtained by students after the learning process takes place,

which can provide changes in knowledge, attitudes and skills of students so that they become better than before. This learning outcome can be measured by giving tests.

In the learning process using the Problem Based Instruction learning method, learning activities are active activities, where students build their own knowledge, students look for their own meaning from what they are learning and adapt new concepts and ideas with a framework that already exists in their minds. In this case students form their own knowledge and the teacher assists as a mediator in the formation process.

Problem Based Instruction Model

The Problem Based Instruction model is one of the learning models that can generate student activity and reasoning, so that student creativity can develop optimally. This is very possible because in Problem Based Instruction, students are trained to answer a real problem related to everyday life.

Problem Based Instruction is a student-centered learning model by exposing students to various problems faced in their lives. With this learning model, students from the beginning have been faced with various life problems that they might encounter later when they graduate from school collapse.

The problem-based instruction (PBI) model in Indonesian has been known since the time of John Dewey. According to Farina Amalia, Saukani & Salminawati (2018) problem-based learning is the interaction between stimuli and responses, which is the relationship between the two directions of learning and the environment. The environment provides input to students in the form of assistance and problems, while the brain's nervous system functions to interpret the aid effectively so that what is faced can be investigated, assessed, and analyzed as well as finding a good solution. Students' experiences obtained from the environment will make materials and materials in order to obtain the same understanding, the guidelines and learning objectives are presented. Problem Based Instruction learning is learning with a constructivist approach, because here the teacher acts as a presenter, questioner, holds a dialogue. Providing research facilities, providing support and encouragement that can enhance students' inquiry and intellectual growth.

According to Taniredja et al (2011) PBI is one of the various learning models that teachers can use in activating students in learning. The teacher is obliged to lead students to carry out activities, the teacher as a problem presenter, provide instructions, guide discussions, provide encouragement and support that can increase the growth of inquiry. The opinion above was clarified by Aryanti Nurhidayati, Rima Sri Agustin, Taufiq Lilo Adi S., Roemintoyo & Eko Supri Murtiono (2013) that PBI is a learning approach that is used to stimulate high-level thinking in situations that are oriented towards real-world challenges. including how to learn.

Meanwhile, according to Rusman (2014) Problem Based Instruction is a learning model that can arouse students' understanding of problems, an awareness of gaps, knowledge, the desire to solve problems, and the perception that they are able to solve these problems.

Based on some of the opinions above, it can be concluded that the Problem Based Instruction (PBI) model is a learning model that uses real-world problems as a

learning context for students through thinking processes and problem-solving skills in order to gain meaningful knowledge and concepts from the learning material. Thus PBI can be used to train and develop various skills, high-level mathematical skills, and increase the achievement of learning outcomes.

Various developments suggest that the main characteristics of the Problem Based Instruction model according to Arend et al in Trianto (2010) are:

a. Asking questions or problems
   The teacher raises real questions in the student environment and can be investigated by students to this authentic problem in the form of a story. Presenting certain phenomena, or demonstrating an event that contains the emergence of a problem or question.
b. Focuses on interdisciplinary linkages
   Although problem-based learning may center on certain subjects (science, mathematics, social sciences) the selected problem is really real so that in solving the problem, students can review various other subjects.
c. Authentic investigation
   Problem-based learning requires students to carry out authentic investigations to find real solutions to the problems presented. This method of presentation depends on the problem being studied.
d. Produce a product or work.
   Learning based on problems requires students to produce certain products in the form of works and demonstrations that explain or represent the form of problem solving they find. The product can also be a report, a physical video model or a computer program.
e. Collaboration.
   Problem-based learning is characterized by students working collaboratively with one another, most often in pairs or small groups. work to engage and exchange opinions in conducting investigations so as to solve the problems presented.

Problem based instruction can be used as an effective approach for teaching higher-order thinking processes. This learning can help students to process ready-made information in their minds and organize their own knowledge. Students must make assumptions, collect information, interpret data, infer, analyze and evaluate. For this reason, this learning model is suitable for developing basic and complex knowledge.

Objectives of the Problem Based Instruction (PBI) Model

Each learning model has a goal to be achieved. As stated by Rusman (2010) that the goal of PBI is the mastery of learning content from the heuristic discipline and the development of problem solving skills. This is consistent with the characteristics of the PBI model, namely learning about the wider life, interpreting information skills, collaborative and team learning, as well as reflective and evaluative thinking skills.

Meanwhile, Aryanti Nurhidayati, Rima Sri Agustin, Taufiq Lilo Adi S., Roemintoyo & Eko Supri Murtiono (2013) put forward the objectives of the PBI model

in more detail, namely: (a) helping students develop thinking and problem solving skills; (b) learn various adult roles through their skills in real life and experiences; (c) becomes the role of students who are autonomous or independent.

The Steps of the Problem Based Instruction Learning Model

Problem Based Instruction is designed to achieve goals such as investigating, understanding and helping students become independent learners. The development of cooperation skills among students is needed in the implementation of problem-based instruction for active investigations with the aim of making them think about the problem and the type of information they need. This model is designed so that students take an active role in a lesson by involving students in real experiences and become independent learning. Student experiences obtained from the environment are used as materials and materials in order to gain understanding and can be used as guidelines and learning objectives. Thus these learning steps can be seen in table 1.

Table 1.
PBI syntax

No	PBI syntax
Stage- 1 Student orientation to the problem	• The teacher explains the learning objectives • Teachers motivate students to be actively involved in learning • Teachers explore students' knowledge about the problems to be discussed
Stage- 2 Organizing students to study	• Students are divided into heterogeneous groups with 4-5 members • Each group gets a student worksheet • The teacher explains the activities in the student worksheets
Stage- 3 Guide investigating individually and groups	• The teacher guides the group to prepare the necessary tools and materials • The teacher provides guidance to students to carry out investigations.
Stage- 4 Develop and present the work	• The teacher guides students to conclude the activities that have been carried out • Each group makes a report and work according to the assigned task • Each groupforward the report
Stage- 5 Analyze and evaluate the problem solving process	• In each group work report presentation, analysis and evaluation of the problem-solving process is carried out. Another group provides feedback. The good comments and feedback are in the form of reflection and evaluation in the investigation carried out, the work steps taken, the results obtained, and the resulting conclusions / answers to the authentic problems that are presented. • The teacher provides reinforcement about the material being studied

Source: Istarani (2014)

Strengths and Weaknesses of the Problem Based Instruction Model

Each learning model has advantages and disadvantages, as a Problem Based Instruction model it also has advantages and disadvantages that need to be considered for its successful use. According to Warsono and Hariyanto (2012):

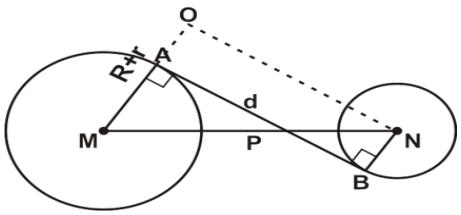
a) The advantages of PBI include:
1. Students will get used to facing problems (problem posing) and are challenged to solve problems not only related to classroom learning but also facing problems that exist in everyday life (real world).
2. Fostering social solidarity by habitually discussing with friends.
3. Increasing teacher familiarization with students.
4. Getting students used to doing experiments.

b) The disadvantages of PBI include:
1. Not many teachers are able to face students to solve problems.
2. Often requires a long time expensive.

Circle

Tangent to Common Circle in Two Circles

The equation tangent to a common circle in two circles involves two circles and a tangent to the circle. For more details, see the image below.



Information:
AB = Tangent to the inner community
NB = the radius of the small circle
MA = the radius of the large circle
MN = The distance between the centers of the circles
MO = The radius of the circle
big and small

Based on the Pythagorean theorem, it is obtained:

MN = p = $\sqrt{(PGSPD)^2 + (R+r)^2}$

AB = PGSPD = $\sqrt{p^2 - (R+r)}2$

MO = $(R+r)$ = $\sqrt{p^2 - PGSPD^2}$

Example:

The distance between the two centers of the circle is 25 cm. If the radius of each circle is 11 cm and 4 cm then the common tangent to the two circles is ...

Dik: R = 11 cm, r = 4 cm, p = 25 cm.

PGSPD ?

Solution:

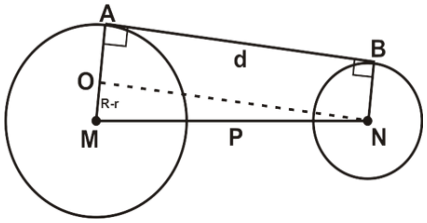
PGSPD = $\sqrt{p^2 - (R+r)^2}$

$$PGSPD = \sqrt{25^2 - (11+4)^2}$$
$$PGSPD = \sqrt{625 - (11+4)^2}$$
$$PGSPD = \sqrt{625 - 15^2}$$
$$PGSPD = \sqrt{625 - 225}$$
$$PGSPD = \sqrt{400}$$
$$PGSPD = 20 \text{ cm}$$

So, the length of the internal common tangent is 20 cm.

Tangent to the Outer Alliance of Two Circles

The equations for a tangent to an external communion are those that at both ends coincide with two parallel circles of different sizes. For more details, see the image below.



Information:
AB = Tangent to outer common
NB = the radius of the small circle
MA = the radius of the large circle
MN = The distance between the centers of the circles
MO = The radius of the circle big and small

$$MN = p = \sqrt{(PGSPL)^2 + (R-r)^2}$$
$$AB = PGSPD = \sqrt{p^2 - (R-r)}2$$
$$MO = (R-r) = \sqrt{p^2 - PGSPL^2}$$

RESEARCH METHODS

The approach used in this research is a quantitative approach. The research sample is one class with one test after learning, so it is classified in the one-shot case study design. The population in this study were all students of 8th grade with a total of 50 students. While the sample is one class of 25 students taken randomly.

Data Collection and Analysis Techniques

The data in this study were obtained through test instruments. The test given is in the form of questions in the form of subjective or description questions. Giving description questions is intended to find out how student learning outcomes using the Problem Based Instruction model on circle material. Giving description questions aims to see the thoroughness of student learning processes and the systematic preparation of answers that can be seen from the steps to solve the questions that are taken. In this study, a one-time test was used, namely the final test given to students after the learning process took place. This final test aims to determine the ability of students after learning using the Problem Based Instruction learning model.

The test was given to students as many as 4 questions were completed in 2x45 minutes. Each question has a different score according to the difficulty level of the question, question number one score 10, question number two score 20, question number three score 30, question number four score 40 with a maximum value of 100.The data that has been collected is then processed using several statistical tests, namely:

Data Distribution Normality Test

To find out whether the data is normal or not, it is tested using the chi square test at the significant level α = 0.05 and degrees of freedom (dk) = (k-3), as stated by Sugiyono (2013).

$X^2 = \sum_{i=1}^{k} \frac{oi-Ei}{Ei}$

Information: O_1 = real frequency of observed results
E_i = the expected frequency
K = the number of interval classes

Hypothesis test

The hypothesis testing method used is the Student test or t-test according to Sugiyono (2013).

$$t = \frac{\bar{x}-\mu o}{s/\sqrt{n}}$$

Where: t = distribution of one-sided student test
μ_o = limit the student's success stage(71)
S = standard deviation
n = lots of data

Due to the right-hand hypothesis test, according to Sugiyono (2013) the criteria for testing that need is to reject Ho if t> t 1-a and accept Ho if t is of another price. The degrees of freedom for the t distribution level are dk = (n-1).

RESULTS AND DISCUSSION

Based on the test results regarding Problem Based Instruction learning on the material tangent to the Inner and Outer Alliance of Two Circles, from 25 students, 4 students were obtained who were still below the KKM score determined by the school.

Normality test

Data normality test is needed to determine the population under investigationnormally distributed or not. In the test for normality, the data is said to be normally distributed if x ^ 2 count <x ^ 2 table.

The formula used for the normality test is:$x^2 = \sum \frac{(Oi-Ei)^2}{Ei}$ (Sugiyono (2013)

From the calculation, it has been obtained X2 count = 2.48 at the significant level α = 0.05 with dk = 7 - 3 = 4, it can be concluded that: data on grade VIII students of State Junior High School 14 Banda Aceh who are taught with Problem Based Instruction on material tangents to the inner and outer partnership of two circles with normal distribution

.

Overview of Hypotheses

The statistic used to test the hypothesis is the t-test formulat = $\frac{\bar{x}-\mu_o}{\frac{s}{\sqrt{n}}}$, using the right-hand test. Based on the test results, it can be concluded that the application of the

problem-based instruction model on the material of the circle of State Junior High School 14 Banda Aceh has reached learning outcomes

DISCUSSION

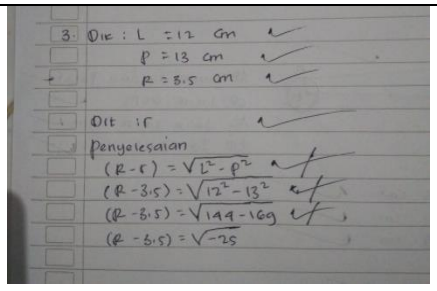
This study aims to determine the learning outcomes of learning outcomes through the application of the Problem Based Instruction model on circle material, especially tangents to the inner and outer alliance of the two circles of State Junior High School 14 Banda Aceh. It is hoped that by applying the Problem Based Instruction learning model, student learning outcomes can achieve learning outcomes , especially in mathematics subjects tangent to the inner and outer communion of the two circles.

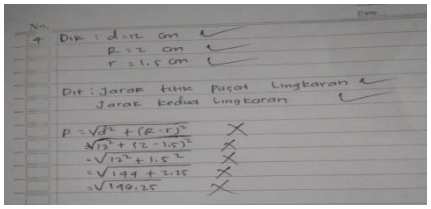
Based on data processing and hypothesis testing that has been carried out by the authors above, it can be concluded that the application of the Problem Based Instruction model on circle material, especially the inner and outer tangent of two circles of 8th grade students of State Junior High School 14 Banda Aceh has achieved learning outcomes . This indicates that the eighth grade students of State Junior High School 14 Banda Aceh as a whole have been able to solve circle material problems, especially tangents to the inner and outer alliance of the two circles well. Problem Based Instruction is innovative student-centered learning (student centered). Problem Based Instruction helps students develop cognitive abilities such as improving student learning outcomes, solving problems and communication skills.

This learning process encourages students to be more active because students are faced with authentic (real) problems which are then resolved by investigation and applied using a problem-solving approach. With problem-based instruction learning students also gain practical experience, more interesting activities so that the teaching materials are not boring and are understood by students, students can learn from various sources, social interactions between students are more developed, students learn to analyze and systematically solve problems . Based on the characteristics of the Problem Based Instruction, the student learning outcomes in the material tangent to the inner and outer partnership of the two circles have increased. So that overall students have achieved learning outcomes .

Although overall student learning outcomes have reached learning outcomes , in the sample there are still 4 students who have not achieved learning outcomes due to incorrect use of the formula so that the score of the answer steps is reduced. The following is the student's answer that was wrong in solving the problems of tangents to the inner and outer community of two circles.

Table 1.
Snippets of Students' Wrong Answers

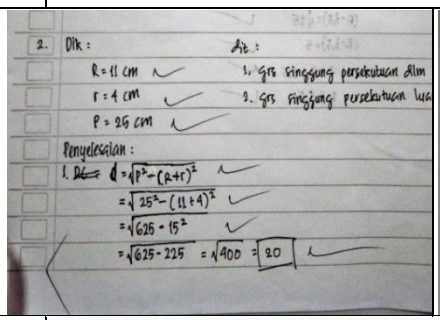
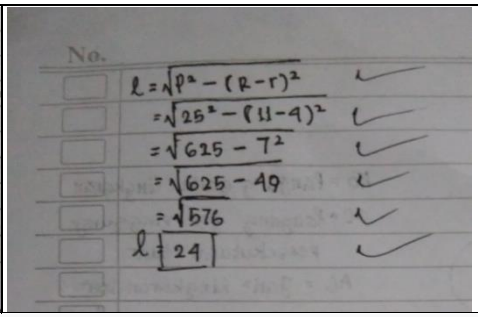
No	Item Question	Student answers
3.	You know that the tangent to the external association of two circles is 12 cm. The distance between the two centers is 13 cm. If the radius of one of the circles is 3.5 cm. calculate the length of the radius of the other circle.	

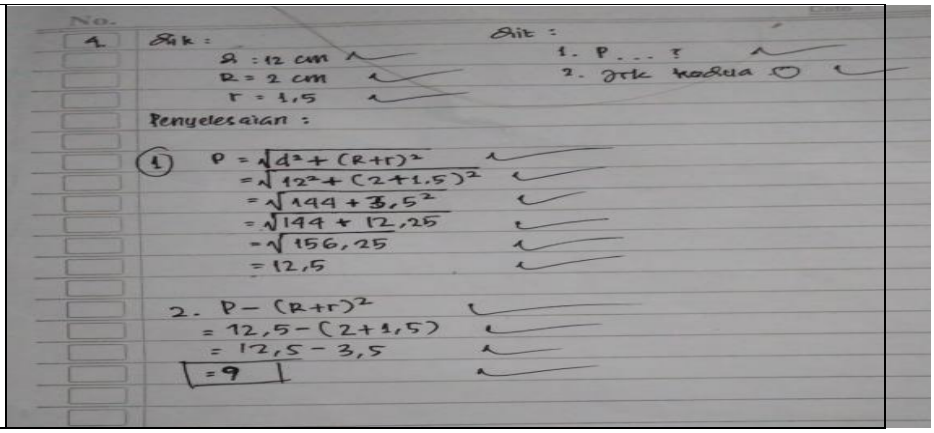
4.	Note that the length of the common tangent to the circle is 12 cm. the radii of the circles 1.5 cm and 2 cm, respectively. Specify: a. the distance between the centers of the two circles b. the distance of the two circles	

Based on table 1 the students still do not understand the material concept of the tangent line between the inner and outer two circles. It can be seen that he answered questions 3 and 4, he was wrong in using the formula, namely the answer to number 3(R-r)=$\sqrt{l^2 - p^2}$which should be the formula used to solve the problem using the formula(R-r)=$\sqrt{p^2 - l^2}$. Likewise, problem number 4 errors in using the formula.

From the above explanation the writer concludes that the difficulties experienced by students in solving problems of tangents to the inner and outer communion of two circles are due to a lack of understanding of the concept of tangents to the inner and outer communion of the two circles and the lack of practice in solving problems of tangents to the inner and outer partnership two circles. Below is an example of the correct student answers regarding the material tangent to the inner and outer partnership of the two circles of State Junior High School 14 Banda Aceh with the Problem Based Instruction model that can meet the KKM scores that have been determined from the school. The results can be seen in Table 4.5 below.

Table 2. Snippets of student's correct answers

2	The two circles have radii, respectively 11 cm and 4 cm. the distance between the two circles is 25 cm. Specify: a. tangent to common in two circles b. tangent to the outer association of the two circles
	
4	Note that the length of the common tangent to the circle is 12 cm. the radii of the circles 1.5 cm and 2 cm, respectively. Specify: a. the distance between the centers of the two circles b. the distance of the two circles



Based on Table 2. These students have understood the questions and have been able to solve them correctly, it's just that students did not make conclusions from these questions so that the results of the students did not get the maximum score. By completing the solution, let us know that p = distance of the center of the two circles, d = distance of tangent to the inner association of two circles, R = radius of the large circle, r = radius of the small circle and what is asked for. So that it forms the formula for the common tangent to the inner and outer union of the two circles.

Warsno and Hariyanto's research (2012), namely: (1) students will get used to facing problems (problem posing) and be challenged to solve problems not only related to classroom learning but also facing problems that exist in everyday life (real world), (2) Fostering social solidarity by accustomed to discussing with friends, (3) the more familiarizing teachers with students, and (4) getting students used to doing experiments.

CONCLUSION

Based on data analysis and discussion of research results on the application of the Problem Based Instruction learning model on the Tangent Line material of the Inner and Outer Partnership of the Two Circles, it can be concluded that: This can be shown from the average value of 78.8 and reinforced by the results of hypothesis testing with the t-test at the level of $\alpha = 0.05$, it is obtained tcount > t-table, namely 4.11>1.711. Thus, students can be said to have achieved learning outcomes .

REFERENCES

- Abdurrahman, Mulyono. 2012. *Pendidikan Bagi Anak Berkesulitan Belajar*. Jakarta: Rineka Cipta.
- Arends. 2011. Mendesain *Model Pembelajaran Inovatif-Progresif. Ed ke 4*. Jakarta: Kencana.
- Arikunto, S. 2014. Prosedur *Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta.
- Aryanti Nurhidayati, Rima Sri Agustin, Taufiq Lilo Adi S., Roemintoyo & Eko Supri Murtiono. 2013. Penerapan Model Pembelajaran Problem Based Instruction Sebagai Upaya Pembentukan Kemandirian Mahasiswa Pada Mata Kuliah Teknik Pondasi. *Jiptek*, VI(1), Januari 2013 . Hal 69-75.
- Dimyati. 2013. *Belajar* dan *Pembelajaran Jakarta*: Rineka Cipta.
- Djamarah. 2011. *Psikologi Belajar Jakarta*: Rineka Cipta.

- Farina Amalia, Saukani & Sal*minawati. 2018. Efektifitas Model Pembelajaran Problem Based Instruction (PBI*) Terhadap Motivasi Belajar Dan Hasil Belajar Siswa Pada Mata Pelajaran Ski Di SMP Ar-Rahman Percut. Farina Amalia: Penerapan Model Pembelajaran. *At-Tazakki*: Vol. 2 No. 1 Januari - Juni 2018 hal. 34-46.
- Fitria. dkk. 2013. Penggunaan Model Problem Based Learning Dengan Multirepsentasi Pada Usaha dan Energi di SMA. Dalam *Jurnal Untan* [Online].Tersedia: http://jurnal.untan.ac.id/index.php/jpdpb/article/download/3723/3728.
- Imadiah. 2019. Peningkatkan Prestasi Belajar Siswa Pada Materi Aplikasi Fungsi Melalui Metode Penemuan Terbimbing. Jurnal Serambi Ilmu, *Journal of Scientific Information and Educational Creativity* 20(1), Edisi Maret 2019. p 79-96.
- Irma Aryani dan Maulida. 2019. Analisis Kesalahan Siswa dalam Menyelesaikan Soal Matematika Melalui Higher Order Thinking Skill (HOTS). *Jurnal Serambi Ilmu, Journal of Scientific Information and Educational Creativity* 20(2), September 2019. p 274-290.
- Istarani. 2014. *58 Model* Pembelajaran *Inovatif.* Medan : Media Persada.
- Kemendikbud. 2013. Kerangka *Dasar Kurikulum 2013*. Kementerian Pendidikan dan Kebudayaan Direktorat Jenderal Pendidikan Dasar. Jakarta.
- Pratiwi, dkk. 2013. *Model Pembelajaran Problem Based Learning Berperngaruh Terhadap Hasil* Belajar *Materi Pecahan Mata Pelajaran Matematika Siswa Kelas IV SD Saraswati Tabanan*. dalam jurnal universitas pendidikan ganesha indonesia [online]. Tersedia: http://ejornal.undiksha.ac.id/index.php/JJPGSD/article/viewFile/1186/1049.
- Purwaningsih, Ira. 2013. Model Pembelajaran *Problem Based Instrucion (PBI) untuk Meningkatkan* Keaktifan *Belajar dan Kemampuan Berpikir Kritis Siswa*, Jurnal *Pendidikan Geografi*. Malang: Universitas Negeri Malang.
- Rusman. 2014. *Model*-Model *Pembelajaran* (Mengembangkan Profesionalisme) Guru. Jakarta: Raja Grafindo Persada.
- Saleh, M (2013) Meningkatkan Pemahaman Siswa Tentang Konsep Pecahan Melalui Benda Manipulatif. *Jurnal Serambi Ilmu*, Edisi September 2013, 14(2). Hal. 119-124.
- Saleh, M., Ernisa., Aklimawati., & Mahmuzah, R. (2019). Pembelajaran Inquiri Based Learning pada Materi Limas SMP Negeri 16 Banda Aceh. *Histogram: Jurnal, Pendidikan Matematika*, doi: http://dx.doi.org/10.31100/histogram.v3i2.405: 3(2), 199 – 209.
- Saleh, M., Muhammad Isa, Murni, Darhim, Bansu Irianto Ansari (2019) Students' Error Types And Reasoning Ability Achievement Using The Indonesian Realistic Mathematics Education Approach. *International Journal Of Scientific & Technology Research* 8(7), July 2019. Issn 2277-8616. P 364-369.

- Saleh, M., Prahmana, R, C, I., Isa, M., & M. (2018). Improving The Reasoning Ability of Elementary School Student Through The Indonesian Realistic Mathematics Education. *Journal on Mathematics Education*, 9(1), 41–54.
- Slameto, 2013, Belajar *dan Faktor-Faktor yang Mempengaruhi*, Jakarta: Rineka Cipta.
- Suci Mahya Sari. 2020. Pengembangan Perangkat Pembelajaran Problem Based Learning (PBL) dalam Pembelajaran Matematika di SMA. *Jurnal Serambi Ilmu, Journal of Scientific Information and Educational Creativity,* 21(2), September 2020. pISSN 1619–4849 eISSN 2549-2306. p 211-228.
- Sugiyono. 2013. Statistika *Untuk Penelitian*. Bandung: CV. Alfabeta.
- Taniredja, dkk. 2011. *Model-Model Pembelajaran Inovatif*. Bandung: Alfabeta.
- Suwangsih dan Tiurlina. 2010. *Model pembelajaran matematika*. Bandung: UPI PRESS.
- Warsono dan Hariyanto. 2012. Pembelajaran *Aktif Teori dan Asesmen*. Bandung: PT Remaja Rosdakarya.
- Manasikana, O. A., Af'idah, N., Bakar, A., Andalia, N., & Safmila, Y. (2023). The Correlation Between Project Learning Models and Student Activities in Online Learning for Innovative Learning Model Courses. Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram, 11(1), 224-231.